

### **REMARKS**

Applicant appreciates the Examiner's thorough examination of the subject application and requests reconsideration of the subject application based on the foregoing amendments and the following remarks. Applicants also acknowledge with thanks the telephone interview with the Examiner to further discuss the rejections of the present invention.

Claims 1-54 are pending in the subject application.

Claims 1-7 and 9-54 stand rejected under 35 U.S.C. §103. Claim 8 was objected to as depending from a rejected base claim, however, the Examiner indicated that this claim would be allowable if appropriately re-written in independent form.

As suggested by the Examiner, claims 1, 20, 30, 40, 42 and 45 were respectively amended as had been so as to further provide that each of the conductors making up the strip array antenna form an independent detector element. Although Applicant believes that the structure of a birdcage coil as disclosed in the cited reference patent is completely different from a strip array antenna of the present invention, in the interests of advancing prosecution, Applicant amended these claims to clearly distinguish the structure of the disclosed birdcage coil.

Claims 1, 30, 40, 42 and 45 also were amended so as to provide that the strip array antenna includes a ground plane.

Claims 5, 19, and 54 were revised to reflect the addition of the ground plane limitation in the related base claim. The preamble of claim 54 also was revised to be consistent with the preamble of the base claim.

Claims 13 and 14 for clarity.

Claims 55, 56 and 62 were added to further claim that the set lengths of each conductor are the same.

Claims 57-61 were added to more specifically claim embodiments of the present invention concerning the Y receivers and the X conductors.

The amendments to the claims are supported by the originally filed disclosure.

### 35 U.S.C. §103 REJECTIONS

Claims 1-7 and 9-54 stand rejected under 35 U.S.C. §103 as being unpatentable over the cited art for the reasons provided on pages 2-8 of the above-referenced Office Action. Applicant respectfully traverses as discussed below. Because claims were amended in the instant amendment, the following discussion refers to the language of the amended claims. However, only those amended features specifically relied upon to distinguish the claimed invention from the cited prior art shall be considered as being made to overcome the cited reference.

More specifically claims 1-7 and 9-54 stand rejected as follows.

(1). Claims 1-7 and 9-24, 26-31, 33-36, 38-49 and 51-54 stand rejected under 35 U.S.C. §103 as being unpatentable over Foo et al. [USP 5,017,872; "Foo"] in view of Fujita et al. [USP 6,169,401; "Fujita"].

(2). Claims 11, 25, 37 and 50 stand rejected under 35 U.S.C. §103 as being unpatentable over Foo et al. [USP 5,017,872; "Foo"] in view of Fujita et al. [USP 6,169,401; "Fujita"] and further in view of Misic, et al. [USP 4,731,584].

(3). Claim 32 stands rejected under 35 U.S.C. §103 as being unpatentable over Foo et al. [USP 5,017,872; “Foo”] in view of Fujita et al. [USP 6,169,401; “Fujita”] and further in view of Liu, et al. [USP 5,898,306].

The following addresses the foregoing rejections. Applicant also has enclosed herewith a Declaration of Ray F. Lee that is submitted in support of the within arguments and thus reference is made in the following discussion/ comments to the paragraphs in this Declaration.

As grounds for the rejection, the above-referenced Office Action provides that Foo discloses a device for detecting near field electromagnetic signals, comprising a strip array antenna, wherein the strip array antenna includes a plurality of conductors arranged so a long axis of each is in parallel and spaced from each other. It also is admitted that Foo, however, does not disclose having the length of each conductor set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor independent of the spacing between adjacent conductors. The Office Action further asserts that Fujita discloses that the length of each conductor is set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor independent of the spacing between adjacent conductors. It thus is concluded in the Office Action that it would have been obvious to one of ordinary skill in that art to modify the antenna disclosed in Foo for the purpose of manipulating the current distribution in accordance with the region from which the highest signal uniformity is desired as shown by Fujita.

Applicant respectfully traverses and disagrees with the characterization of what is allegedly disclosed or taught in either of the two cited references. Applicant also asserts that the

suggested modification to the birdcage coil that is disclosed in Foo would completely destroy the intended purposes, function and operation of the birdcage coil disclosed therein.

Applicant claims, claim 1, a device for detecting near field electromagnetic signals, comprising a strip array antenna. A strip array antenna according to the present invention includes a plurality of conductors arranged so a long axis of each is in parallel and spaced from each other. Claim 1 was further amended to state explicitly that each of the conductors is an independent detector element of the strip array antenna. It also is provided that a length of each conductor is set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors. The claim also was amended to include a ground plane that is arranged so that all of the conductors are spaced from one surface of the ground plane.

As indicated in Applicant's prior remarks, as is described and discussed in the subject application, and as illustrated in a number of the figures thereof, each conductor of the strip array antenna of the present invention forms an independent detector element of the strip array antenna so that each conductor can independently detect electromagnetic signals. As is more clearly shown in FIG. 9A for example, each of the conductors 140 comprising the strip array antenna 100 is coupled to an independent channel of an NMR/ MRI system.

In contrast to the present invention, Foo does not describe a strip array antenna as that term is used and described in the subject application. Instead Foo describes a cylindrical MRI

coil<sup>1</sup> that is referred to therein and by those skilled in the art as a "birdcage" coil. In Foo, it is clearly shown and described therein that all conducting strips extend axially in the cylindrical coil and are connected to each other by end rings (see 19, 22 in figure 1 thereof). Because all the conductor elements are electrically connected to each other (as well as being tightly coupled together) the structure formed is clearly a coil, as is described in Foo, not an array of conductors that comprise independent detector elements as in the present invention.

Applicant again submits that the birdcage coil shown in Foo cannot disclose, teach or suggest the invention as set forth in claim 1, as essential structure of the birdcage coil would have to be eliminated in order to form the strip array antenna structure of the claimed invention. Such a modification is not a permissible grounds for rejection as stated in the following.

As provided in MPEP 2143.02, a prior art reference can be combined or modified to reject claims as obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Additionally, it also has been held that if the proposed modification or combination would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. Further, and as provided in MPEP-2143, the teaching or suggestion to make the claimed combination and the reasonable suggestion of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

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<sup>1</sup> Declaration of Ray F. Lee dated February 2, 2004 (hereinafter Lee Declaration), paragraph. nos. 6-7.

As provided by the Federal circuit, a 35 U.S.C. §103 rejection based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in a reference, is not proper and the prima facie case of obviousness cannot be properly made. In short there would be no technological motivation for engaging in the modification or change. To the contrary, there would be a disincentive. *In re Gordon*, 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984). In the present case it is clear that if the cited reference (Foo) was modified in the manner suggested by the Examiner it would destroy the intent, purpose or function of the device as taught by the reference.

It is clear that in order to arrive at the structure of the claimed invention the end rings of the birdcage coil in Foo would have to be eliminated. Such a modification would make destroy the cylindrical volume defined by the axial legs and the end rings of the birdcage coil. Such a modification also would destroy the ability of the birdcage coil to receive circularly polarized MRI signals<sup>2</sup>. Such a modification also would involve changing the manner in which the outputs from the birdcage coil are arranged as well as how MRI signals are outputted from a birdcage coil. In this regard, Applicant would again draw the Examiner's attention to the remarks in pages 5-6 (Applicant's Response to Office Action dated May 20, 2003) which specifically detail the problems if the birdcage coil was modified so as to yield a strip array antenna as set forth in claim 1.

In sum, no one skilled in the MRI arts would have been reasonably apprised by the structure and disclosure in Foo that a birdcage coil could be modified into the form of the strip array antenna of the present invention and yield a device that could detect MRI signals. Such a

teaching is inherently inconsistent with the purpose and function of a birdcage coil and thus such a modification cannot be said to naturally or inherently flow from the disclosures and illustrated structures in Foo.<sup>3</sup>

As indicated above, to advance prosecution Applicant amended claim 1 to explicitly provide that each of the conductors forms an independent detector element of the strip array antenna. Thus, in view of this amendment, Applicant would note that the language of claim 1 now specifically and explicitly excludes the structure of a birdcage coil.

Applicant also amended claim 1 to provide that the strip array antenna includes a ground plane that is arranged so that each of the conductors is spaced (e.g., spaced a predetermined distance) from one side of the ground plane. In the Office Action remarks regarding claims 5, 19 and 54, it is suggested that the shield in Foo discloses the ground plane of the present invention. In this regard, Applicant would note that the ground plane of the present invention is not just a shield to prevent loss, but rather serves as part of the circuit of the strip array antenna to complete the electromagnetic field path. This is nowhere described, taught or suggested anywhere in Foo.<sup>4</sup>

Although the foregoing remarks should be sufficient to distinguish the invention set forth in claim 1 from the cited combination of references, Applicant also makes the following additional remarks as to the secondary and any tertiary references.

As to the secondary reference and as also indicated herein, the Office Action asserts that Fujita discloses that the length of each conductor is set so as to substantially reduce coupling of a

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<sup>2</sup> Lee Declaration, paragraph nos. 6-7.

<sup>3</sup> Lee Declaration, paragraph nos. 5-7, 12

signal in one of the plurality of conductors to an adjacent conductor independent of the spacing between adjacent conductors and that it would have been obvious to one of ordinary skill in that art to modify the antenna disclosed in Foo for the purpose of manipulating the current distribution in accordance with the region from which the highest signal uniformity is desired as shown by Fujita. Applicant respectfully disagrees with the characterization of what is being disclosed or taught by Fujita.

As previously indicated by Applicant, Fujita does not disclose nor describe a strip array antenna as is taught and claimed by Applicant.<sup>5</sup> In Fujita, all conducting strips in the coil described therein are directly interconnected to each other by means of conducting end legs as is clearly shown in figures 2-4 thereof (see also claim 1 thereof). Fujita also specifically describes the detection device therein as being a quadrature highpass ladder surface coil.

Fujita nowhere explicitly states that the length of the conductors are established so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor independent of the spacing between adjacent conductors. Moreover, Fujita nowhere explicitly states that the length of the conductors is set so as to be equal to be about  $n\lambda/4$ , where  $n$  is an integer  $\geq 1$  and  $\lambda$  is the wavelength of the signal to be detected.

This is not surprising, as it was not within the knowledge of those skilled in MRI arts at the time Fujita was filed that one could set the length of conductors that are arranged in the fashion set forth in claim 1, so as to substantially reduce signal coupling between adjacent

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<sup>4</sup> Lee Declaration, paragraph nos. 8-9, 22

<sup>5</sup> See Applicant's Response to Office Action, dated May 20, 2003, pages 6-9.



conductors without regard to the spacing between the conductors. In fact it was accepted by those skilled in the art, that signal coupling between adjacent conductors was dependent upon the spacing between the conductors and that if the spacing was reduced sufficiently signal coupling would occur.<sup>6</sup>

As also explained in the subject application (*e.g.*, see pages 3-4 thereof), other techniques (*e.g.*, phased array of surface coils with tuned and matched circuits) have been used to de-couple adjacent loops as a mechanism for improving SNR and field of view. It is further stated in the subject application that as the spacing between the adjacent coils and between adjacent portions of a coil is decreased, signal coupling is increased irrespective of the tuned and matched circuits. Consequently, there becomes a practical limit as to how many coils and how dense the surface coils can be made before it is no longer possible to use the tuned and matched circuit technique to de-couple the adjacent coils.

The Office Action refers to the language in Fujita (col. 4, l. 66- col. 5, l. 3) that the desired imaging region will determine the spacing and/ or length used for the conductors or legs of the highpass ladder coil described in Fujita. From this it appears that the Examiner has concluded that this inherently discloses or teaches setting the length as is set forth in claim 1. Such a conclusion is incorrect and further it is submitted that this would not be apparent to those skilled in the MRI arts. As indicated herein, to those skilled in the MRI arts, signal coupling between adjacent conductors was dependent upon the spacing between the conductors and no one skilled in the MRI arts would have believed that one could set the length of the conductors so as

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<sup>6</sup> Lee Declaration, paragraph nos. 15-16.

to substantially eliminate coupling between adjacent conductors independent of the spacing between the conductors.<sup>7</sup>

Also, Fujita talks about controlling the spacing and/ or length in connection with the highpass ladder surface coil illustrated in Figure 3 thereof, to manipulate the odd or even current distributions in accordance with the region from which the highest signal uniformity is desired; in other words the non-uniform spacing and/ or length of conductor alters the detectable current densities in the view field. Such language also does not disclose or teach setting the conductor length so as to eliminate signal coupling.

Moreover, in Fujita the surface coil includes a number of legs that are interconnected to each other by means of side elements 40,42. These legs and side elements form loops as illustrated by the current paths illustrated in Fig. 2, which clearly indicates that the geometry and configuration of the quadrature highpass ladder surface coil in Fujita is completely different from the structure of the strip array antenna as set forth in claim 1.<sup>8</sup>

In sum, Fujita does not

- (1) explicitly disclose, teach or suggest setting the length of the conductor so as to substantially reduce coupling of a signal in one conductor to an adjacent conductor(s) regardless of the spacing between the adjacent conductors; nor

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<sup>7</sup> Lee Declaration, paragraph nos. 15-16, 18

<sup>8</sup> Lee Declaration, paragraph nos. 19-20

- (2) inherently disclose, teach or suggest setting the length of the conductor so as to substantially reduce coupling of a signal in one conductor to an adjacent conductor(s) regardless of the spacing between the adjacent conductors.

The foregoing remarks also apply to distinguish each of claims 20, 20, 40, 42 and 45 from the cited combination of references.

As to claims 9-10, 24, 36, 48 and 49 it is asserted that Foo disclose terminating the conductors in the fashion set forth in each of these claims. As indicated above, Foo describes a birdcage coil where the axial conductors are interconnected to ring conductors so as to form a cylindrical structure. It is clear from the figures in Foo and as is known to those skilled in the art, the end of each of the axial conductors is not terminated. Also, the discussion referred to in Foo merely relates to the fact that a standing wave is produced in prior art coils (col. 3) and that a non-zero dielectric supports standing wave between the surface boundaries (col. 4). The cited discussion in Foo does not describe or discuss anywhere the termination of the individual axial conductors beyond there coupling to the ring conductors. Given that the coil in Foo is for excitation, it also can hardly be said that Foo discloses techniques for terminating the conductors for purposes of creating a standing or traveling wave in each conductor.<sup>9</sup>

As to claims 12, 26 and 51 the Office Action refers to the feature identified by reference numeral 11 in figure 1 of Foo as being a signal guard mechanism as well as the discussion in col. 7, lines 3-17. Applicant respectfully traverses as it appears that the Examiner is using this feature of Figure 1 to represent the ground plane and the signal guard mechanism. Applicant cannot

state for certain because the Office Action merely made reference to figure 1 as disclosing the encapsulation member of claim 5 without specifically equating a reference numeral to the features of this claim. However, the only element in Fujita that could be disposed on a substrate on a side that is opposite to the side on which the axial conductors is disposed, and thus be structurally equated to the ground plane is the shield 11. As such, Applicant respectfully submits that if the shield represents a guard mechanism of the claimed invention then it cannot be at the same time a ground plane.

It is respectfully submitted that at least for the foregoing reasons each of the other dependent claims of the subject application are distinguishable from the combination of references cited in the Office Action. In particular, given that the Foo discloses a birdcage coil Applicant respectfully submits that the tertiary references Misic and Liu do not overcome the above noted deficiencies. Also, in view of that stated above that the axial conductors in a bird cage coil are not individual terminated, there can be no suggestion, teaching or motivation offered to combine the teachings of either of Misic or Liu with the birdcage coil disclosed in Foo even as modified by the teachings of Fujita.

As to claims 6-7, Applicant would note that the encapsulation/ substrate/ overlay material is such that the wavelength of the electromagnetic wave is reduced so as to be in a desired range.

As is known to those skilled in the art, the wavelength decreases as the static magnetic field strength ( $B_0$ ) of the MRI scanner is increased (*e.g.*,  $\lambda_0 \cong 4$  meters when  $B_0 = 1.5T$  and  $\lambda_0 \cong 1$  meter when  $B_0 = 1.5T$ ).

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<sup>9</sup> See also Lee Declaration, paragraph no. 21.

The Federal Circuit has indicated in connection with 35 U.S.C. §102 that in deciding the issue of anticipation, the trier of fact must identify the elements of the claims, determine their meaning in light of the specification and prosecution history, and identify *corresponding elements* disclosed in the allegedly anticipating reference (emphasis added, citations in support omitted). *Lindemann Maschinenfabrik GMBH v. American Hoist and Derrick Company et al.*, 730 F. 2d 1452, 221 USPQ 481,485 ( Fed. Cir. 1984). Notwithstanding that the instant rejection is under 35 U.S.C. §103, in the present case the Examiner has not shown that the birdcage coils or surface coils of Foo or Fujita correspond, as that term is used above by the Federal Circuit, in any fashion to the strip array antenna and the constituents thereof in their entire claimed form as set forth in any of the independent claims of the present invention.

As provided in MPEP 2143.01, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F. 2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F. 2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). As provided above, the references cited, alone or in combination, include no such teaching, suggestion or motivation.

Furthermore, and as provided in MPEP 2143.02, a prior art reference can be combined or modified to reject claims as obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Additionally, it also has been held that if the proposed modification or combination would change the principle of

operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. Further, and as provided in MPEP-2143, the teaching or suggestion to make the claimed combination and the reasonable suggestion of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

As can be seen from the forgoing discussion regarding the disclosures of the cited references, there is no reasonable expectation of success provided in any reference that if the birdcage coil in Foo was modified so as to yield the strip array antenna of the present invention in any of its claimed forms such a modified coil would be reasonably successful. Also, it is clear from the foregoing discussion that the modification suggested by the Examiner would change the principle of operation of the device disclosed in Foo.

As stated by the Board Of Patent Appeals and Interferences; "...Before obviousness may be established, the Examiner must show that there is either a suggestion in the art to produce the claimed invention or a compelling motivation based on sound scientific principles." *Ex Parte Kranz*, 19 U.S.P.Q. 2d 1216, 1218 ( BPAI 1990) (emphasis added). The Federal Circuit also has indicated that a prior art reference that gives only general guidance and is not all that specific as to particular forms of a claimed invention and how to achieve it, may make a certain approach obvious to try, but does not make the invention obvious. *Ex Parte Obukowicz*, 27 USPQ2d 1063, citing *In re O'Farrell*, 853 F.2d 894, 7 USPQ2d 1673,1681 (Fed. Cir. 1988).

As the Federal circuit has stated, "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art

suggested the desirability of the modification.” *In re Fritch*, 972 F.2d 1260,1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor. *Para-Ordance Mfg. v. SGS Importers Int’l, Inc.*, 73 F.2d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995).

It is respectfully submitted that for the foregoing reasons, claims 1-7 and 9-54 are patentable over the cited reference(s) and satisfy the requirements of 35 U.S.C. §103. As such, these claims are allowable.

#### CLAIM 8

In the above-referenced Office Action, claim 8 was objected to as being dependent upon a rejected base claim. It also was provided in the above-referenced Office Action, however, that these claims would be allowable if rewritten in independent form to include all the limitations of the base claim and any intervening claim(s).

In as much as Applicant believes that the base claim is in allowable form, claim 8 was not re-written in independent form as suggested by the Examiner. Applicant, however, reserves the right to later amend the subject application so as to present this claim in independent form or to add an independent claim that contain the limitations of claim 8.

#### CLAIMS 55-62

As indicated above, claims 55-62 were added to more distinctly claim aspects or embodiments of the present invention.

More specifically, claims 55, 56 and 62 were added so as to explicitly claim that the set lengths of the conductors are set so as to be the same. Claims 57, 59 and 61 were added to specifically claim the embodiment where a single receiver is provided that includes a plurality or more of input channels and where each of the conductors is connected to a respective one of the plurality or more input channels. Claims 58 and 60 were added to explicitly claim the case where  $X$  conductors equals  $Y$  receivers (e.g., see claim 33).

These claims are clearly supported by the originally filed disclosure, including the originally filed claims.

Applicant also respectfully submits that these added claims are patentable over the cited prior art on which the above-described rejection(s) are based. It is further submitted that further search and examination is not required at least because the base claim for each of the added dependent claims is considered to be in allowable form. As such, Applicant respectfully requests entry of the added claims into the subject application.

It is respectfully submitted that the subject application is in a condition for allowance. Early and favorable action is requested.

Because the total number of claims and/or the total number of independent claims post amendment now exceed the highest number previously paid for, a check is enclosed herewith for the required additional fees. However, if for any reason a fee is required, a fee paid is inadequate



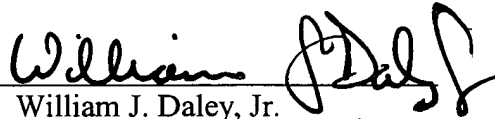
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or credit is owed for any excess fee paid, the Commissioner is hereby authorized and requested to  
charge Deposit Account No. **04-1105**.

Respectfully submitted,  
Edwards & Angell, LLP

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By:



William J. Daley, Jr.  
(Reg. No. 35,487)  
P.O. Box 9169  
Boston, MA 02209  
(617) 439- 4444

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